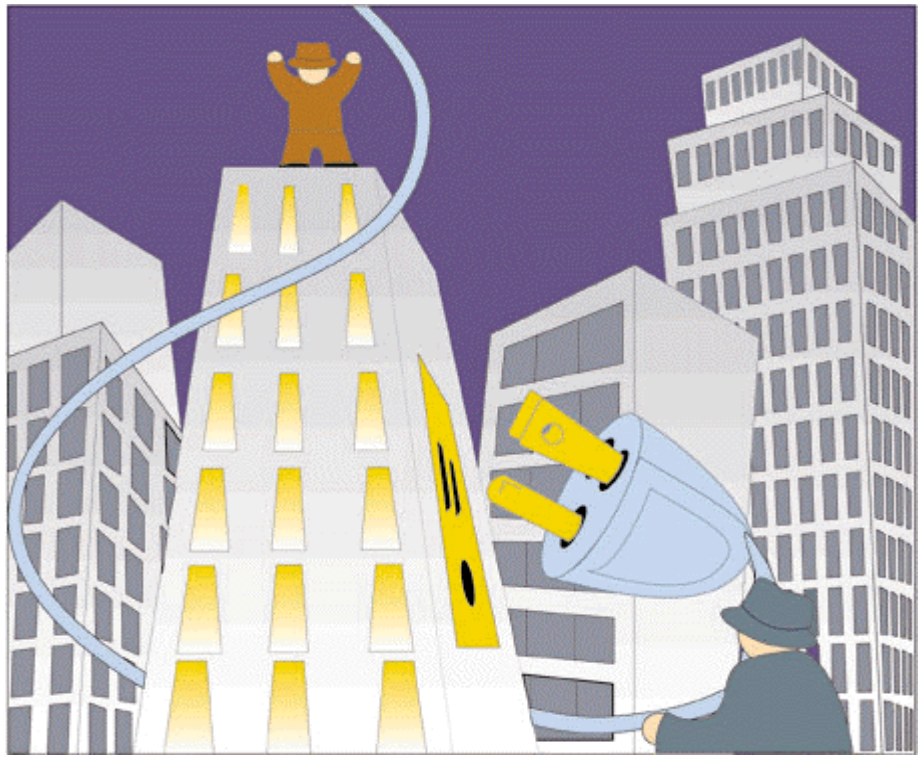
Distribution and Interconnection R&D: Strategic Roadmap Planning

Track 2, 3, 5: Strategic Roadmap - Interconnection Technology and Electrical Distribution Systems



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Tracks 2-3-5
Interconnection Technology and Electrical Distribution Systems

- Foundation
- Priority needs
- R&D activities
- Appropriate role for DOE

DOE R&D Activity Discussion Tracks - Example Topics

Track 2

- Standards
- Certification process
- Interconnection technology platform
- Certification of interconnection equipment
- Interconnection test lab

Track 3

- EDS needs assessment
- Intentional islanding
- Protection schemes
- Micro grid operation
- Sensors and controls

Track 5

- Integrate SMARTConnect™ technology platforms
- Advanced protection scheme design
- Demo protection scheme
- Advanced grid control
- Advanced SCADA
- Smart substations

Track 2 - Industry Priority Needs

- Standards that clearly state the requirements for interconnection of DER equipment
- Modular, standardized interconnection devices that allow DER to be readily and inexpensively interconnected with the electrical distribution system
- Digital programmable relays, improved sensors and controls, and expert systems that enable real-time dispatch and monitoring of DER units

Track 2 - Industry R&D Activities

- Integrating interconnection equipment with the genset
- Use of more reliable, lower cost components (digital design, advanced processors)
- Producing more accurate and reliable meters
- Improving communication and control device flexibility so that components may be networked
- Adapting communications and control systems to handle multiple gensets
- Increasing the type of information logged by data systems and improving event sequencing analysis
- Providing better feedback and alarm controls for a larger variety of electronic metrics

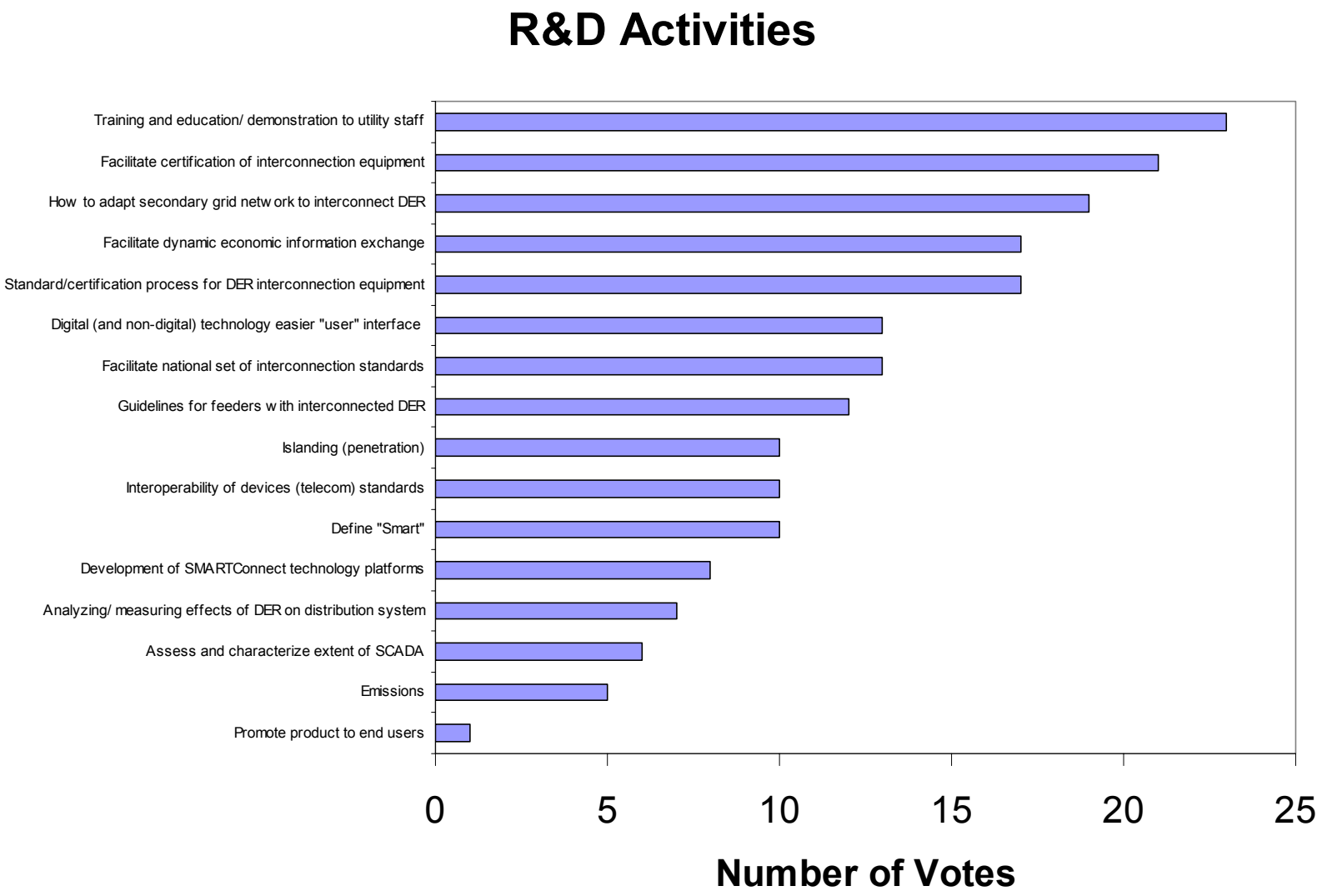
Track 2 - DOE R&D Activities

- Facilitate national set of interconnection standards, e.g. 1547 standards
- Standard/certification processes to cover interconnection equipment for all DER, e.g. UL/ANSI 1741
- Development of interconnection system technology platforms of SMARTConnect™
  - Non-inverter interconnection technology
  - Inverter interconnection technology
- Facilitate certification of interconnection equipment
- Establishment of DER system interconnection test labs

Track 2 - Summary Points

- Interoperability of devices and systems -- standard connection interface and communication protocols
- Education and training
- Create certainty through certification
- We have lots of technology, but no standards for use -- need easier user interface
- Even with standards completed, still need testing and certification
- Business and contracting issues are as important as technical issues
- Great that some utilities were present, need to consider input of all stakeholder groups

Interconnection R&D Activities



Track 3 - Industry Priority Needs

- New protection schemes (e.g., fault detection, anti-islanding, controlled islanding) for two-way power flow
- System control models that incorporate automatic local contingency response
- Modifications to the electrical distribution system that increase its reliability, lower maintenance costs, and ensure secure operations in the face of crippling natural or terrorist activities
- Low-cost converter technologies that enable direct current distribution networks
- Improved distribution system VAR support without necessarily adding new generating capacity

Track 3 - Additional Identified Needs

- Education and outreach - distribution engineering, operations staff, planning staff, regulators
- T&D book revised, including interactive models and examples
- Simulation tools, DER models
- Lower cost technology
- Lower cost service
- Data and information exchange
- Standardized, open communication architecture

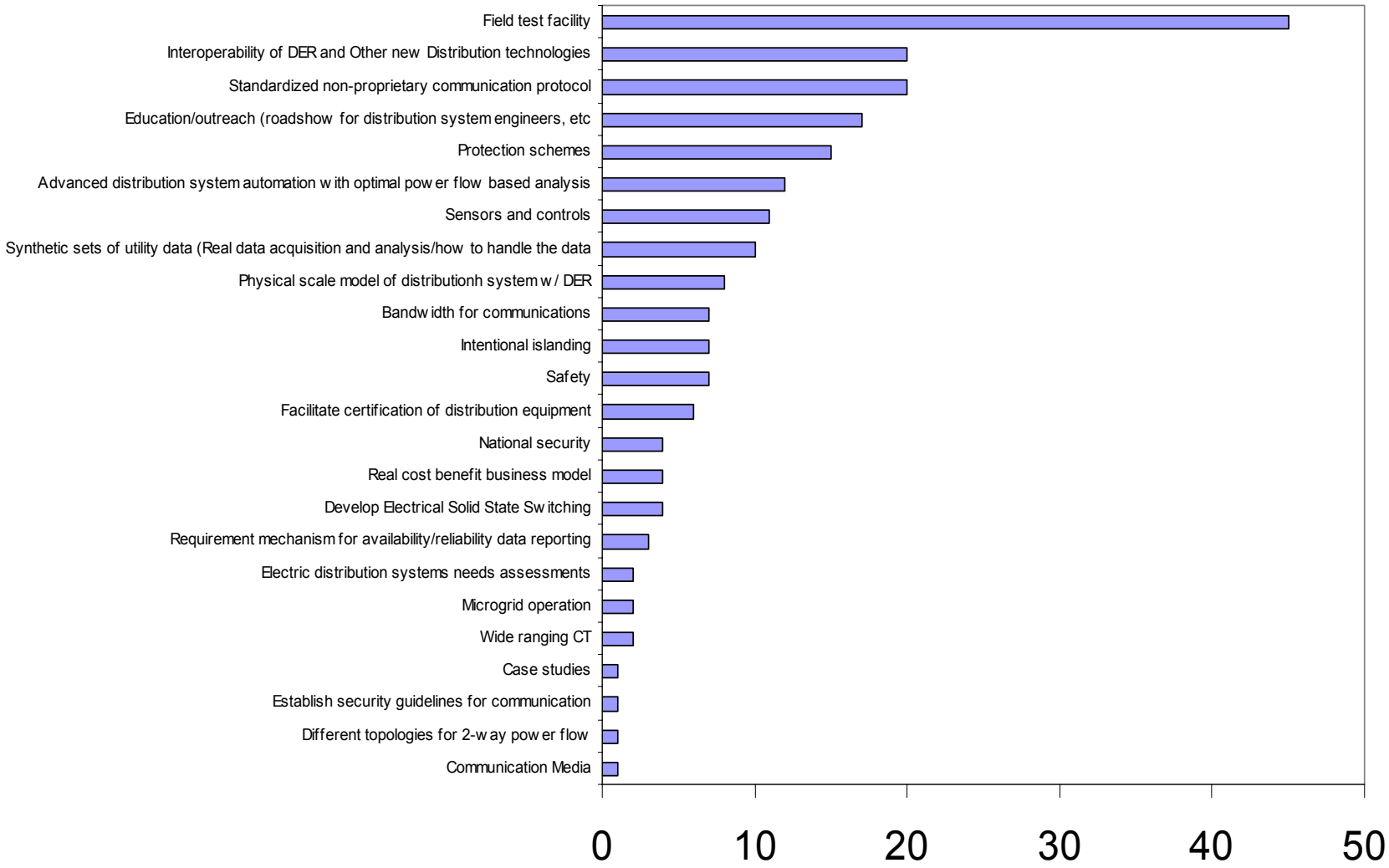
Track 3 - Industry R&D Activities

- Convergence of hardware and software in protective relaying and communication devices
- Improving protective relay performance
- Increasing surge withstand immunity
- Providing controls for real-time operation and monitoring

Track 3 - DOE R&D Activities

- Electric distribution systems needs assessment
- Intentional islanding
- Protection schemes
- Micro grid operation
- Sensors and controls
- Facilitate certification of distribution equipment

EDS R&D Activities



Track 3 - Details for Key Activities

- Field test facility
- Interoperability of DER and other new distribution technologies
- Standardized non-proprietary communication protocol
- Education/outreach (roadshow for distribution system engineers, etc.)
- Protection schemes
  - Objectives and outcomes
  - Interactions with other DOE activities
  - Identify types of organizations that can work with DOE

Track 5 - Industry Priority Needs

- Interfaces that control power flow, voltage and frequency
- Advances in low-cost communication and control networks and advanced SCADA that enable aggregations of DER to be an integrated operation with the scalability to meet individual user, facility, and utility requirements
- Real-time monitoring equipment for incipient fault detection and self-repair
- Smart substation designs that allow real-time control of DER microgrids and other DER units interconnected to the substation's distribution feeders

Track 5 - Additional Identified Needs

- New hardware to evolve from current EDS to future smart system
  - electronic breaker
  - improved protective relaying coordination

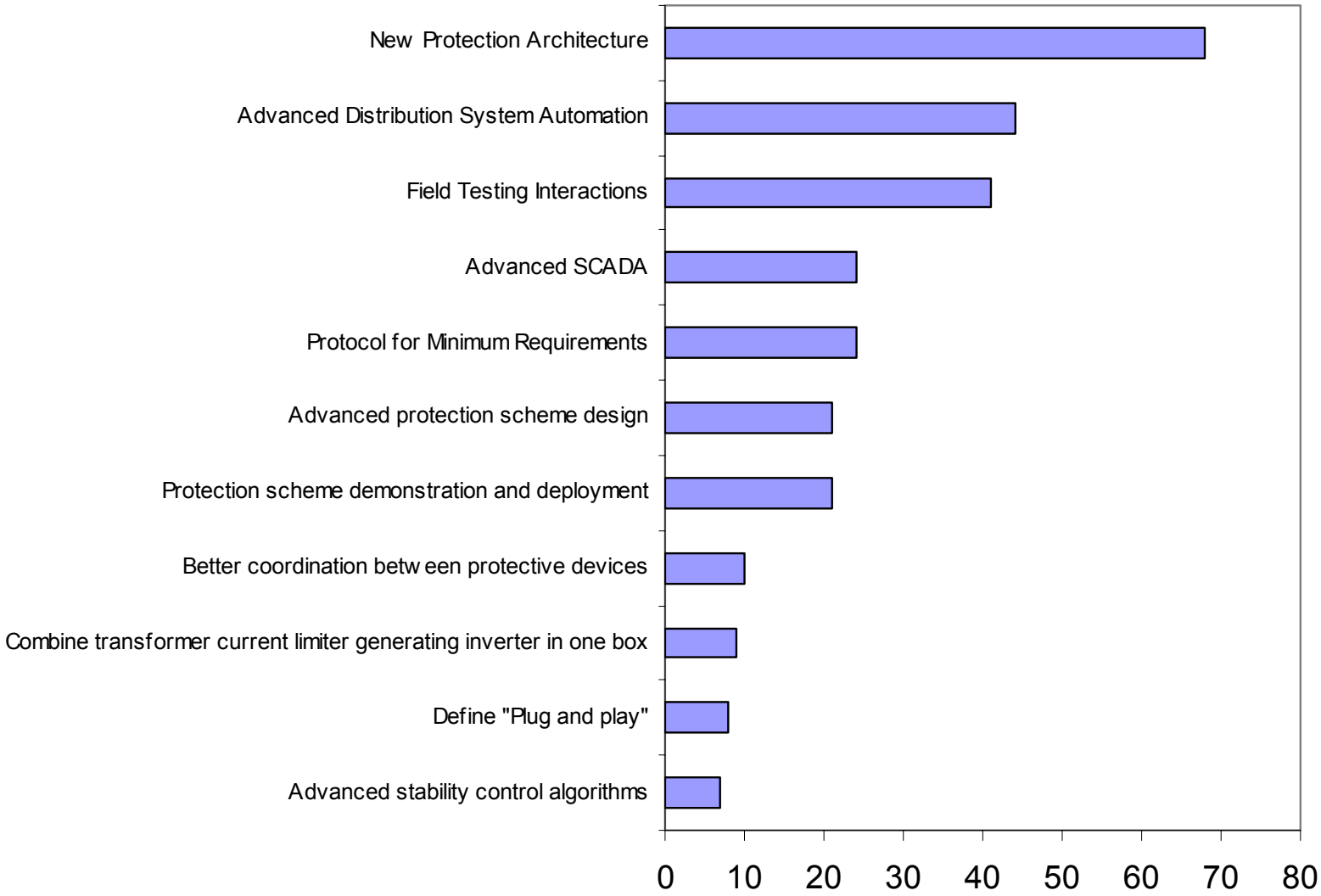
Track 5 - DOE R&D Activities

- Integration of SMARTConnect™ technology platforms
- Advanced protection scheme design
- Protection scheme demonstration and deployment
- Advanced SCADA
- Other advanced grid control
- Smart substations

Track 5 - DOE R&D Activities (continued)

- Certification
  - Lab accreditation
  - Quality certification
  - Certification authority
- Testing
  - DER system integration field test facilities
  - Industry collaborative testing

Interconnection and EDS R&D



Track 5 - Details for Key Activities

- Simulate interaction of DER with the grid
- Advanced distribution system automation
- Advanced SCADA
- Better coordination between protective devices
- Advanced controls within inverters
  - Objectives and outcomes
  - Interactions with other DOE activities
  - Identify types of organizations that can work with DOE

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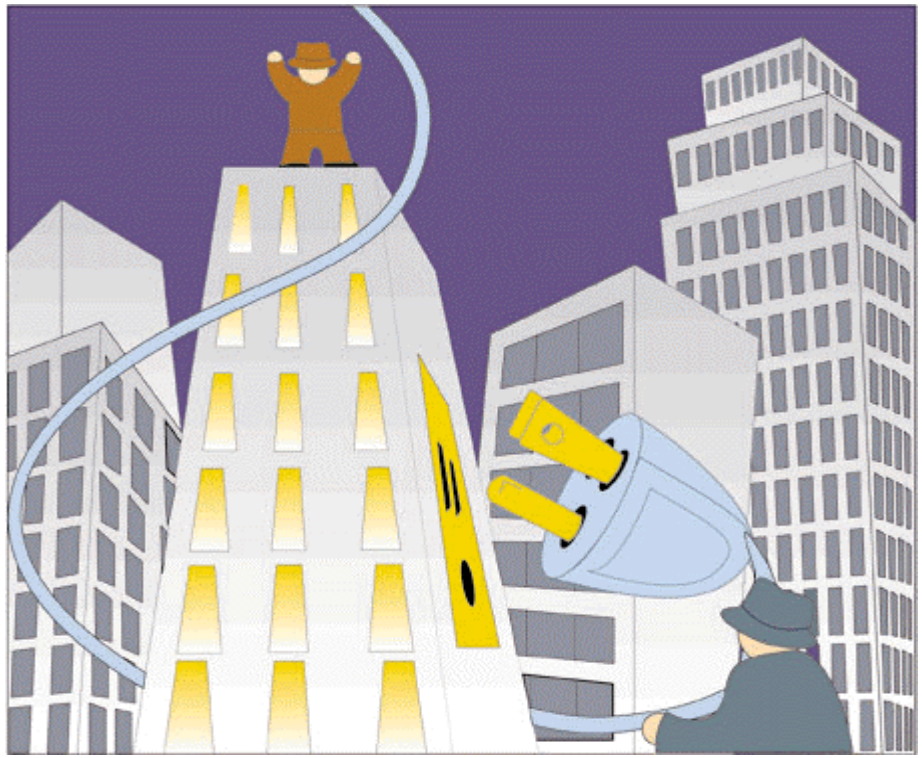

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